PATENT ABSTRACTS OF JAPAN

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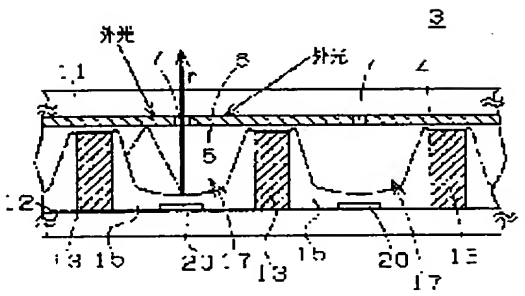
(71)Applicant : OMRON CORP
(72)Inventor : ISAMOTO KEIJI
SHINOHARA MASAYUKI
AOYAMA SHIGERU

(54) PLASMA DISPLAY DEVICE AND PLASMA DISPLAY SUBSTRATE THEREOF

(57)Abstract:
PROBLEM TO BE SOLVED: To improve contrast without damaging brightness by having an opening corresponding to each pixel on the front surface of a plasma display panel, and providing a light control plate having a light-reflecting surface on its discharge cavity side and a light-absorbing surface on its front surface side.



SOLUTION: A light control plate 4 is inserted between a surface glass bard 11 and cavities 17 of a plasma display panel, having the cavities 17 in which gas for causing a fluorescent coating 15 to emit light, is sealed. The cavity 17 side of the light control plate 4 is a high reflectance surface 5, and the opposite front surface side is a light-absorbing surface 6. Respective light-transmitting holes 7 are opened at positions corresponding to the centers of the cavities 17. External light going into the surface glass board 11 is absorbed by the light-absorbing surface 6 of the light control plate 4, and is hardly reflected to the front surface side. Where as because the light emitted from fluorescent coating 15, after reflecting repeatedly on the high reflectance surface 5 and the inner surfaces of the cavities 17, or directly passes through the light transmission holes 7, it then goes out to the front surface, so that small light transmitting holes 7 causes light to go out efficiently.

LEGAL STATUS

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CLAIMS

[Claim(s)]
[Claim 1] Plasma display equipment equipped with the light-absorption side which is arranged rather than a cavity at a front-face side, is arranged at a front-face side towards the plasma display panel equipped with the cavity by which the closure was carried out in the gas for making a fluorescent substance emit light by discharge, and said cavity side rather than the light-reflex side which has opening corresponding to each pixel of a plasma display panel, and the field which has said reflection property towards said cavity and opposite side, and has opening corresponding to each pixel of a plasma display panel.
[Claim 2] Plasma display equipment according to claim 1 characterized by preparing a lens array in a front-face side rather than said light absorption side.
[Claim 3] The substrate for plasma displays which consists of a glass substrate, a light reflex side which has opening corresponding to each pixel of a plasma display panel, and a light absorption side which has opening corresponding to each pixel of a plasma display panel.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to plasma display equipment and the substrate for plasma displays.
[0002]
[Description of the Prior Art] (The 1st conventional example) Generally as an image display device, a liquid crystal display and plasma display equipment are known. Among these, plasma display equipment has the descriptions, such as a thin shape, a light weight, and a high angle of visibility, and is a device promising for a large-sized flat TV for home use together with a liquid crystal display.
[0003] The structure of a plasma display panel is shown in drawing 1 . A plasma display panel 10 is a spontaneous light type, as shown in drawing 1 , the cavity (cel) 17 corresponding to a pixel is formed between the insides of the surface glass substrate 11 and the rear-face glass substrate 12, and each cavity 17 is divided by the septum 13. Among the insides of a cavity 17, the field except the inside of the surface glass substrate 11 serves as a fluorescent substance spreading side, and fluorescent paint 15 is applied to the whole front face of a fluorescent substance spreading side. Moreover, a low voltage gas is enclosed in a cavity 17, and the anode electrode 20 and the cathode electrode 22 which impress an electrical potential difference to a low voltage gas are arranged by the inside of the rear-face glass substrate 12, and the inside of the surface glass substrate 11, respectively. And if an electrical potential difference is impressed to a low voltage gas with the anode electrode 20 and the cathode electrode 22, the light r which fluorescent paint 15 emitted light and emitted light from the front face of fluorescent paint 15 by the ultraviolet rays generated by gas discharge will penetrate the surface glass substrate 11, and outgoing radiation will be carried out. In addition, 18 in drawing expresses the low voltage gas of the plasma state.
[0004]
[Problem(s) to be Solved by the Invention] The above plasma display panels have a large angle of visibility compared with a liquid crystal display, it is advantageous in respect of big-screen-izing, and there is the advantage in which color reproduction nature is also still better, but on the other hand an improvement of the contrast of an image and improvement in brightness have been an important technical problem.
[0005] In order to be dependent also on surrounding brightness, generally the contrast of a plasma display panel is divided into dark-room contrast and ** room contrast, and is evaluated. In the conventional plasma display, dark-room contrast has become 50:1 to about 300:1, and ** room contrast has become 40:1-50:1. About dark-room contrast, it has reached to practically almost infallible level. The fall of the ** room contrast by reflection of outdoor daylight poses a problem.
[0006] In order to solve the problem of this ** room contrast, the approach adopted conventionally arranges ND filter (Neutral Density Filter) 2 in the front face of a plasma display panel 10 like the plasma display equipment 1 shown in drawing 2 . Although outdoor daylight passes along ND filter 2 twice [a total of] by a unit of 1 time before and after reflecting with a

plasma display panel 10, the light which emits light with a plasma display panel 10 passes ND filter 2 only once. Therefore, if transmission of ND filter 2 is set to alpha (<1), the brightness of the light which emitted light with the plasma display panel 10 will serve as alpha double next door, and outdoor daylight will serve as alpha2 twice. If setting transmission of ND filter 2 to alpha=1/2, speaking concretely, the light and outdoor daylight which emitted light with the plasma display panel 10 will be 1/2, and times [alpha = / alpha2=1 / 4 times] the basis, respectively, and contrast will be set to 2:1. Therefore, the brightness of plasma display equipment improves relatively and the ** room contrast of outdoor daylight reflex time is improved.

[0007]

[Problem(s) to be Solved by the Invention] however, by such approach, although ** room contrast improves, since the light which emitted light with the plasma display panel also passes an ND filter at once, the quantity of light will fall alpha twice (for example, 0.5 times). Now, the brightness of the plasma display equipment which is another technical problem fell, and it was not able to be said that it was the ideal contrast improvement approach.

[0008] The place which this invention is made in view of the fault of the above-stated conventional example, and is made into the purpose is to offer the plasma display equipment which can improve contrast, without reducing the brightness of a screen.

[0009]

[Description of the Invention] (1st operation gestalt) The plasma display equipment indicated to claim 1 The plasma display panel equipped with the cavity by which the closure was carried out in the gas for making a fluorescent substance emit light by discharge, The light reflex side which is arranged rather than a cavity towards said cavity side at a front-face side, and has opening corresponding to each pixel of a plasma display panel, It is arranged at a front-face side rather than the field which has said reflection property towards said cavity and opposite side, and is characterized by having the light absorption side which has opening corresponding to each pixel of a plasma display panel.

[0010] If it is in plasma display equipment according to claim 1, the outdoor daylight which carried out incidence can be made to absorb according to a light absorption side. Moreover, outgoing radiation of the light generated in the cavity of a plasma display panel is carried out from each opening of a light reflex side and a light absorption side to a front face, repeating reflection inside a light reflex side and a cavity. Therefore, the contrast of outdoor daylight reflex time can be raised, without reducing the outgoing radiation effectiveness of light.

[0011] The embodiment according to claim 2 is characterized by preparing a lens array in a front-face side rather than said light absorption side in plasma display equipment according to claim 1.

[0012] With this plasma display equipment, since outgoing radiation of the light generated in the cavity is carried out through opening of a light absorption side and a light reflex side, it is good, and can control the directivity of light. [of affinity with a lens]

[0013] The substrate for plasma displays according to claim 3 is characterized by consisting of a glass substrate, a light reflex side which has opening corresponding to each pixel of a plasma display panel, and a light absorption side which has opening corresponding to each pixel of a plasma display panel.

[0014] If this substrate for plasma displays is used as a glass substrate of a plasma display panel, the plasma display equipment of this invention can be manufactured without changing a production process.

[0015]

[Embodiment of the Invention] Drawing 3 is the sectional view showing the plasma display equipment 3 by 1 operation gestalt of this invention. Since this improves to the plasma display panel 10 shown in drawing 1 , it gives the same sign to the same component, and omits explanation. If it is in this plasma display equipment 3, the optical control strip 4 is inserted between the dielectric layers 23 and the surface glass substrates 11 which have covered the cathode electrode 22. As for this optical control strip 4, the field by the side of a cavity 17 is the high high reflection factor side 5 (for example, total reflection layer) of the rate of a light reflex,

and the front face of the opposite side is the light absorption side 6. And as shown in drawing 4 , opening of the light transmission hole 7 is carried out to this optical control strip 4 in the core of each pixel of a plasma display panel 10, respectively. Especially as for the configuration of the light transmission hole 7, a round hole, a square hole, etc. are not limited.

[0016] As a deer is carried out and it is shown in drawing 5 , the outdoor daylight which carried out incidence to the surface glass substrate 11 of plasma display equipment 3 is absorbed in respect of [6] the light absorption of the optical control strip 4, and is hardly reflected in a front-face side. Speaking concretely, the outdoor daylight which carried out incidence of the area of S and the light transmission hole 7 for an area of 1 pixel to A, then plasma display equipment 3 being able to make very small the ratio in which it is reflected in only at a rate of A/S at most, but outdoor daylight is reflected by making the light transmission hole 7 small. On the other hand, since the light transmission hole 7 of the optical control strip 4 is passed and outgoing radiation is carried out to the front face of a plasma display panel 10 after the light r which emitted light with the fluorescent paint 15 in a cavity 17 passing the light transmission hole 7 of the optical control strip 4 immediately or reflecting repeatedly between the high reflection factor side 5 of the optical control strip 4, and cavernous 17 inside, even if it makes the light transmission hole 7 small, outgoing radiation of the light can be carried out efficiently. Therefore, according to this plasma display equipment 3, the contrast at the time of outdoor daylight incidence can be raised, without reducing the brightness of a pixel. Especially this operation gestalt has a desirable pixel to the plasma display equipment of DC mold separated in a grid pattern by the septum 13.

[0017] Drawing 6 shows the relation between the rate of protection from light of the relation between the rate of protection from light of the outdoor daylight at the time of using an ND filter, and the outgoing radiation effectiveness of the light to a front face, and the outdoor daylight at the time of using the optical control strip 4 of this invention, and the outgoing radiation effectiveness of the light to a front face. Here, as the plasma display equipment 3 of this invention used for measurement is shown in drawing 7 (a) and (b), the thickness of Lp=300micrometer and a septum 13 is [the height of D= 50 micrometers and a septum 13] H= 100 micrometers, a pixel pitch has the light transmission hole 7 with the optical square control strip 4, and external surface turns into the light absorption side 6 in respect of [5] the high reflection factor to which an inside carries out total reflection of the light. In addition, the reflection factor in a cavity 17 is 0.9. Here, when area of the light transmission hole 7 was set to B (=S-A) in the case of the plasma display equipment 3 of this invention, the rate of protection from light calculated the area of the light absorption side 6 within A and 1 pixel by B/S. Since the rate of protection from light will be set to 0.75 when the permeability of an ND filter is alpha= 0.5 if drawing 6 is seen, the outgoing radiation effectiveness is set to 0.5. On the other hand, when outgoing radiation effectiveness is similarly 0.5, the rate of protection from light is set to 0.87 with the plasma display equipment 3 of this invention. Therefore, according to this invention, it turns out that contrast can be made high, without reducing outgoing radiation effectiveness.

[0018] (2nd operation gestalt) Drawing 8 is the sectional view showing the plasma display equipment 31 by another operation gestalt of this invention fractured in part. If it is in this operation gestalt, the lens array 32 is attached in the front face of a plasma display panel 10. As for the lens array 32, each lens 33 is arranged in the shape of two-dimensional corresponding to a pixel. Each lens 33 prepared in the lens array 32 is arranged so that it may correspond to each pixel and 1 to 1, and its core of the light transmission hole 7 of the optical control strip 4 corresponds with the optical axis of each lens 33 of the lens array 32.

[0019] If it is in this plasma display equipment 31, since light r emitted from each pixel is point-light-source-ized by passing the light transmission hole 7 of the optical control strip 4, the light r which could control easily with the lens 33, for example, came out of each pixel is also convertible for collimation light after lens array 32 passage.

[0020] (3rd operation gestalt) The decomposition perspective view and drawing 10 which show plasma display equipment 34 according [drawing 9] to still more nearly another operation gestalt of this invention and which were fractured in part are the rear-face Fig. of an optical control strip. This plasma display equipment is plasma display equipment of AC mold, the cavity

17 has extended for a long time in the one direction, and the septum 13 with which it divides between each cavity 17 corresponding to it is also prolonged for a long time in parallel with the cavity 17. It is desirable for a front face to open the light transmission hole 7 of the shape of a slit prolonged in the direction which intersects perpendicularly with a cavity 17 and a septum 13 in the optical control strip 4 whose rear face is the high reflection factor side 5 in respect of [6] light absorption in the case of such an AC mold. For every pixel, you may form one slit-like light transmission hole 7 at a time, and may prepare it two or more [at a time] (in drawing 10 R> 0, two light transmission holes 7 per pixel are formed). Moreover, what is necessary is just to put the rod-lens array 35 which arranged the rod lens 36 prolonged in the direction parallel to a cavity 17 on the front face of a plasma display panel 10, in preparing a lens array.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the sectional view showing the structure of a plasma display panel.
[Drawing 2] It is the schematic diagram showing the configuration of the conventional plasma display equipment which has improved the contrast of outdoor daylight reflex time using an ND filter.
[Drawing 3] It is the sectional view showing the configuration of the plasma display equipment by 1 operation gestalt of this invention fractured in part.
[Drawing 4] It is the top view which the optical control strip piled up above the cavity fractured the part.
[Drawing 5] It is the operation explanatory view of this invention.
[Drawing 6] It is drawing showing the relation between the rate of protection from light of the plasma display equipment of this invention, and conventional plasma display equipment equipped with the ND filter, and the outgoing radiation effectiveness of light.
[Drawing 7] It is drawing explaining the sample of this invention used for measurement same as the above, and the outline sectional view in which (a) shows the structure for about 1 pixel, and (b) are the top views showing the optical control strip for 1 pixel.
[Drawing 8] It is the sectional view showing the configuration of the plasma display equipment by another operation gestalt of this invention fractured in part.
[Drawing 9] It is the perspective view showing the configuration of the plasma display equipment by still more nearly another operation gestalt of this invention fractured in part.
[Drawing 10] It is the bottom view of an optical control strip same as the above.
[Description of Notations]
4 Optical Control Strip
5 High Reflection Factor Side
6 Light Absorption Side
7 Light Transmission Hole
11 Surface Glass Substrate
12 Rear-Face Glass Substrate
13 Septum
15 Fluorescent Paint
17 Cavity
32 Lens Array

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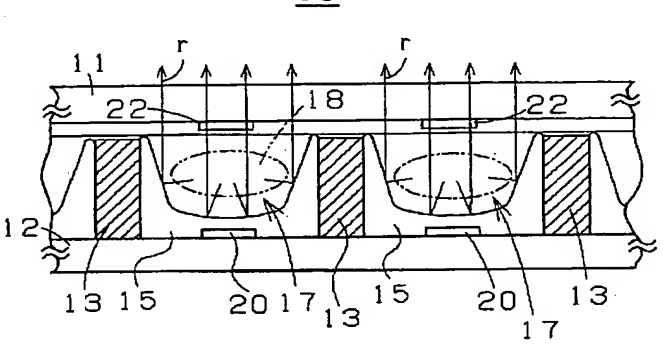
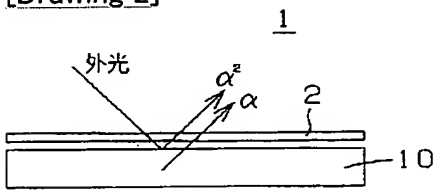
DRAWINGS

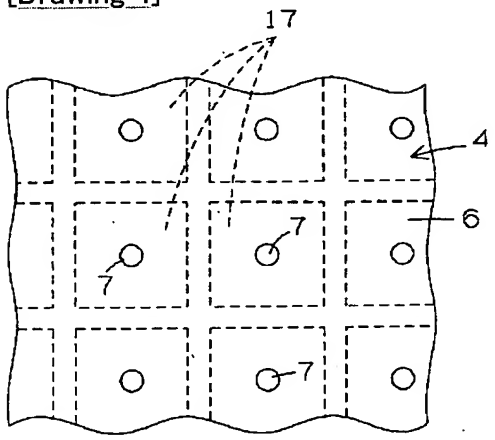
[Drawing 1]



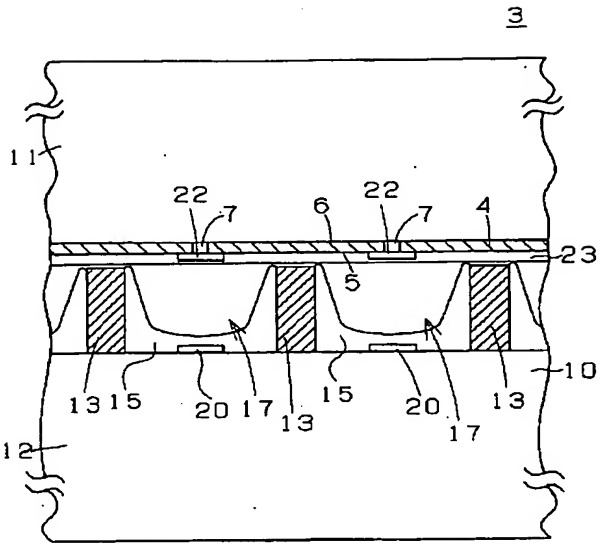
[Drawing 2]



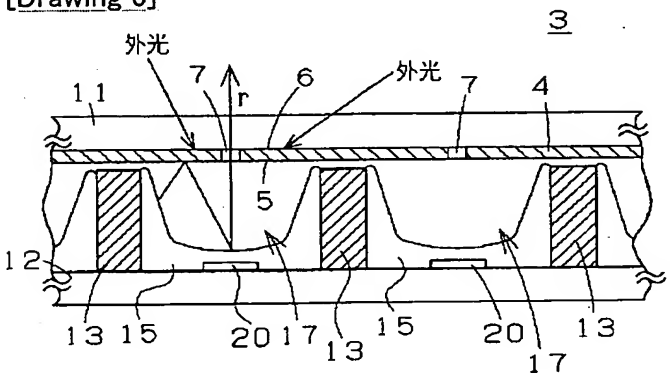
[Drawing 4]



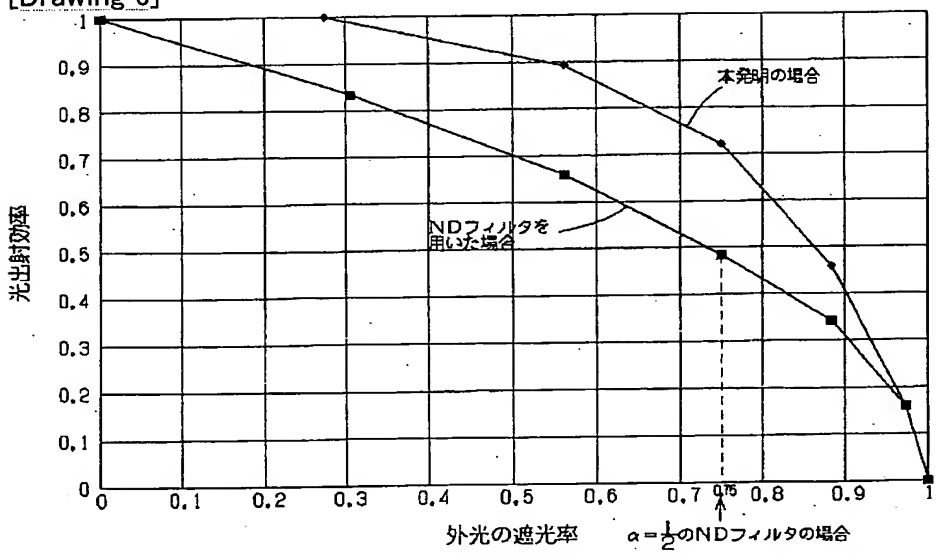
[Drawing 3]



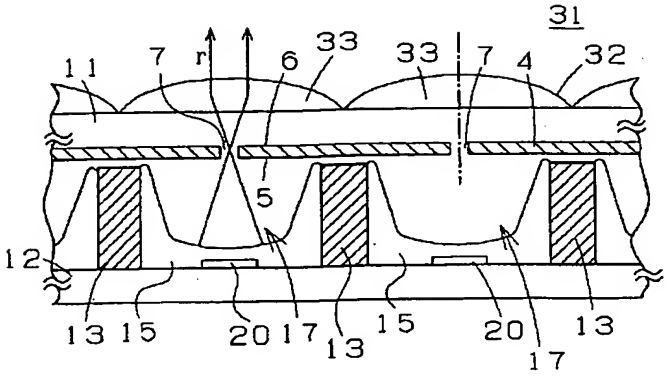
[Drawing 5]



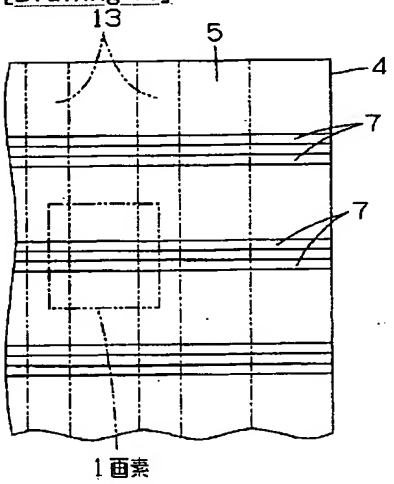
[Drawing 6]



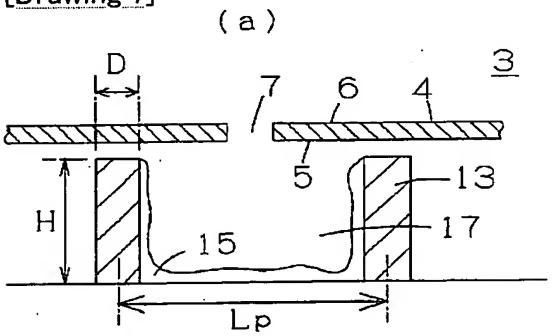
[Drawing 8]

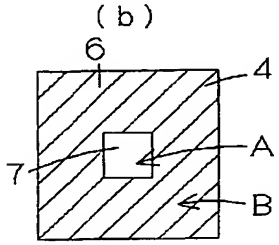


[Drawing 10]

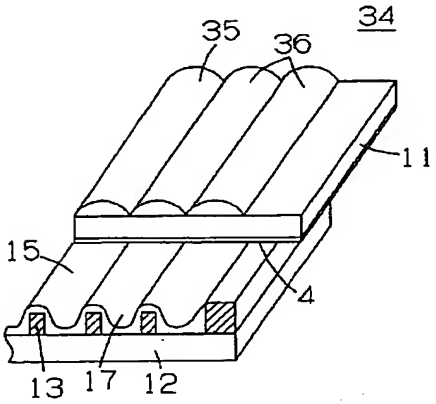


[Drawing 7]





[Drawing 9]



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